Johnson Controls, Inc
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Office of the General Counsel

JOHNSON CONTROLS

June 8, 1981

U.S. Environmental Protection
Agency - Region 5
Sites Notification
Chicago, Illinois 60604

Gentlemen:

Enclosed are the filings for the Environmental Protection Agency Notification of Hazardous Wastes pursuant to the Federal Register's requirements dated April 15, 1981.

Very truly yours,

JOHNSON CONTROLS, INC.

Irene Bialas/dlk
Irene Bialas
Division Counsel

IB:dlk

Enclosures

RESPONDENT CONTACT RECORD (RCR)

FACILITY ID NUMBER	COMPANY NAME			
	Johnson Controls, Inc			
COMPANY ADDRESS		CITY	STATE ABBREV.	ZIP CODE
CONTACT PERSON'S NAME/TITLE			TELEPHONE NUMBER (INCLUDE AREA CODE)	
			-	

CONTACT RECORD

DATE	CONTRACTOR'S INITIALS	ITEMS DISCUSSED/RESOLUTION
7-28	C Allen	Person to contact needed.

TABLE E-3

GROUNDWATER ELEVATION .TA

ELEVATION IN FEET TO U.S.G.S. DATUM

	DATE								
LOCATION	3/22/83	4/28/83	7/05/83	10/07/83	1/13/84	7/10/84	10/12/84	12/06/84	2/14/85
MW-1	734.13	734.48	734.24	732.45	732.83	736.65	732.70	733.25*	733.08
MW-2	729.75	733.06	732.47	731.10	737.60	726.40	731.62	737.22*	732.21
MW-3	745.11	744.23	740.55	735.64	743.35	741.88	741.70	743.43*	742.51
MW-4	727.06	731.75	733.10	732.62	729.48	720.20	731.92	737.62*	732.14
MW-5								732.63	732.60
MW-6								734.13	734.05
MW-7								734.37	734.82
MW-8								736.27	735.11
MW-9								736.16	735.33
MW-10								729.64	735.51
MW-11								732.41	732.30
MW-12								732.87	732.68
MW-13								732.46	733.10
MW-14								735.72	735.04
MW-15								728.03	728.83
TH-1								+736	
Imp #1								739.16	
Imp #2	743.26					±745	±745	743.18	743.20

*Measurements taken by Battery personnel on 12/05/84.

the clayey sediments, and these sediments have some minor lenses of sand and gravel. The sand and gravel lenses are discontinuous between borings for the most part. The fence diagram in the additional hydrogeological investigative work (Appendix E-4) provides a good illustration of the uppermost aquifer.

INTERCONNECTION OF UNDERLYING AQUIFERS

A deep boring was made in December of 1984 on the Battery site (MW-15 on Figure 1 in Appendix E-4). The boring log is included in Appendix E-4. A discussion of the interconnection between the uppermost aquifer in the clayey sediments and the aquifer in the sandstone formation is found in Appendix E-4. The shale layer between the clayey sediments and sandstone prevents any direct interconnection between the zones of saturation. However, a small amount of leakage through the shale layer can be expected over time. The elevation of the piezometric surface in the uppermost aquifer is about 5 feet above the piezometric surface of the aquifer in the sandstone formation. The specific yield of the shale would be about 0.04 based on values in the literature. The thickness of the shale layer is about 20 feet, and the vertical hydraulic conductivity would be about that of they clayey sediments which are just above the shale (5.7×10^{-7} cm/sec.). A typical groundwater velocity through the shale layer is calculated below:

$$V = 5.7 \times 10^{-7} \frac{\text{cm}}{\text{sec}} \times \frac{5 \text{ feet}}{20 \text{ feet}} \times \frac{1}{0.04} \times \frac{2835 \text{ ft/day}}{\text{cm/sec}}$$

$$V = 0.0100984 \text{ ft/day}$$

The time it would take for groundwater to travel through the 20 feet of shale is calculated below.

t = 20 ft/0.0100984 ft/day = 1980 days or 5.42 years

The value of hydraulic conductivity used in these calculations is a conservatively high estimate, and lower values of hydraulic conductivity would lengthen the travel time accordingly.

GROUNDWATER FLOW DIRECTION AND RATE

Groundwater contours are interpreted on Figure 2 in Appendix E-4 for a complete set of groundwater elevation data. Figure 3 in Appendix E-4 shows the groundwater contours that would exist without the groundwater mound created by the impoundments. The gradient computed on Figure 3 of Appendix E-4 is 0.006 ft/ft in a north-northwest (NNW) direction. The horizontal hydraulic conductivity is usually 3 to 5 times the vertical hydraulic conductivity, and the prevailing groundwater velocity across the impoundment site was calculated to be in the range of 3.3×10^{-8} ft/day to 5.5×10^{-8} ft/day in the NNW direction (see Appendix E-4).

WATER QUALITY STANDARDS

Groundwater quality standards are set forth in 40 CFR Part 257. Table E-4 presents the groundwater quality standards from Appendix 1 of 40 CFR 257. These groundwater quality standards are identical to the maximum contaminant levels set forth in 40 CFR Part 141 under the Interim Primary Drinking Water Standards. Appendix I also contains standards for maximum microbiological and radioactivity contaminants levels which are not listed on Table E-4, since these standards cannot be summarized on a table and are not likely to be applicable to the Battery facility.

There are National Secondary Drinking Water Standards which are not federally enforceable but are intended for use as water quality guidelines for drinking water. The secondary maximum contaminant levels are presented on Table E-5, and are parameters which primarily effect the aesthetic qualities of drinking water.

The State of Michigan has surface water quality standards under the Water Resources Act, Act 245 of 1929, as amended. These surface water quality standards are not easily reduced to tabular form. Total dissolved solids standards of 500 milligrams per liter (mg/l) on a monthly average, and 750 mg/l for a maximum level in surface water are specified for controllable point sources. The range of pH allowed in surface water is from 6.5 to 8.8 standard units.

TABLE E-5

NATIONAL SECONDARY DRINKING WATER STANDARDS

The secondary maximum contaminant levels for public water systems are as follows:

Contaminant	Level
Chloride	250 mg/L
Color	15 color units
Copper	1 mg/L
Corrosivity	Noncorrosive
Foaming agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3 threshold odor number
pH	6.5–8.5
Sulfate	250 mg/L
Total dissolved solids (TDS)	500 mg/L
Zinc	5 mg/L

These levels represent reasonable goals for drinking water quality. The States may establish higher or lower levels which may be appropriate dependent upon local conditions such as unavailability of alternate source waters or other compelling factors, provided that public health and welfare are not adversely affected.

TABLE E-4

GROUNDWATER QUALITY STANDARDS

APPENDIX I

The maximum contaminant levels promulgated herein are for use in determining whether solid waste disposal activities comply with the ground-water criteria (§ 257.3-4). Analytical methods for these contaminants may be found in 40 CFR Part 141 which should be consulted in its entirety.

1. *Maximum contaminant levels for inorganic chemicals.* The following are the maximum levels of inorganic chemicals other than fluoride:

Contaminant	Level (milligrams per liter)
Arsenic	0.05
Barium	1
Cadmium	0.010
Chromium	0.05
Lead	0.05
Mercury	0.002
Nitrate (as N)	10
Selenium	0.01
Silver	0.05

The maximum contaminant levels for fluoride are:

Temperature[1] degrees Fahrenheit	Degrees Celsius	Level (milligrams per liter)
53.7 and below	12 and below	2.4
53.8 to 58.3	12.1 to 14.6	2.2
58.4 to 63.8	14.7 to 17.6	2.0
63.9 to 70.6	17.7 to 21.4	1.8
70.7 to 79.2	21.5 to 26.2	1.6
79.3 to 90.5	26.3 to 32.5	1.4

[1] Annual average of the maximum daily air temperature.

2. *Maximum contaminant levels for organic chemicals.* The following are the maximum contaminant levels for organic chemicals:

	Level (milligrams per liter)
(a) Chlorinated hydrocarbons:	
Endrin (1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo, endo-5,8-dimethano naphthalene)	0.0002
Lindane (1,2,3,4,5,6-Hexachlorocyclohexane gamma isomer)	0.004
Methoxychlor (1,1,1-Trichloro-2,2-bis (p-methoxyphenyl) ethane)	0.1
Toxaphene ($C_{10}H_{10}Cl_8$-Technical chlorinated camphene, 67 to 69 percent chlorine)	0.005
(b) Chlorophenoxys:	
2,4-D (2,4-Dichlorophenoxy-acetic acid)	0.1
2,4,5-TP Silvex (2,4,5-Trichlorophenoxypropionic acid)	0.01

WATER QUALITY DATA EXCEEDING STANDARDS

The groundwater data in Appendix E-2 were compared to the standards on Tables E-4 and E-5. The exceedances are discussed by parameter below.

Sulfate

The recommended limit for sulfate was exceeded in MW-2 and MW-4 in July and October, 1983. Sulfate levels remained higher in these wells than the other wells (MW-1 and MW-3) from October, 1983 on, but were below the recommended limit.

Arsenic

Arsenic concentrations were higher than the water quality standard in MW-2 in July and October, 1983. Since 1983, concentrations of arsenic in MW-1 through MW-4 have been less than the detection limit.

Cadmium

Cadmium concentration standards were exceeded in each of the monitoring wells, even the upgradient well, on one or more sampling dates. The QA/QC data (when available) make most of this data suspect.

Iron

Iron was above the recommended limit on one or more dates for each well. Some of the data are suspect because of blanks and duplicates that do not check, and total concentrations that are less than filtered sample concentrations.

Lead

Lead concentrations were higher than the water quality standard for MW-1 and MW-4 in July, 1983. These were the only exceedances of the lead standard that occurred. MW-1 is the upgradient well.

Manganese

Manganese concentrations were higher than the recommended limit on the following occasions for the following wells.

MW-1	7/6/83; 10/14/83; 1/17/84
MW-2	7/6/83; 10/14/83
MW-3	7/6/83; 10/14/83; 1/17/84; 4/23/84; 7/6/84
MW-4	7/6/83; 10/14/83; 1/17/84

PLUME OF CONTAMINATION

A plume of contamination has not been clearly defined by the groundwater quality data collected to-date. There have been episodes of groundwater quality exceeding standards or limits, but these episodes do not appear connected either in space or time.

A significant increase of specific conductance in MW-2 was shown with the October, 1984 groundwater quality data. The specific conductance of MW-2 has always been higher than the other wells (MW-1, MW-3, and MW-4). MW-1 is upgradient and always had the lowest specific conductance. It is believed that the reason for the higher specific conductance in wells near the impoundments (MW-2, MW-3, and MW-4) is due to an increase in calcium, magnesium, and sodium cation in the groundwater caused by a replacement of these cations with hydrogen ions in the soil matrix. The hydrogen ions may be supplied from the compound H_2SO_4 in the impoundments. Therefore, a plume of groundwater with increased hardness may be found downgradient of the impoundments if this scenario is correct.

The groundwater quality assessment plan is a monitoring plan under Interim Status regulations which includes sampling some of the new monitoring wells drilled in November of 1984. This additional monitoring hopefully will provide the additional information needed to define the plume of contamination (if any), hazardous waste constituents, and background water quality.

POINTS OF COMPLIANCE

Points of compliance are proposed on the topographic map. Points include MW-2, MW-4, MW-5, MW-5, MW-7, MW-11, and MW-12. These seven wells are to the north and west of the two surface impoundments which are downgradient of both impoundments.

HAZARDOUS WASTE CONSTITUENTS

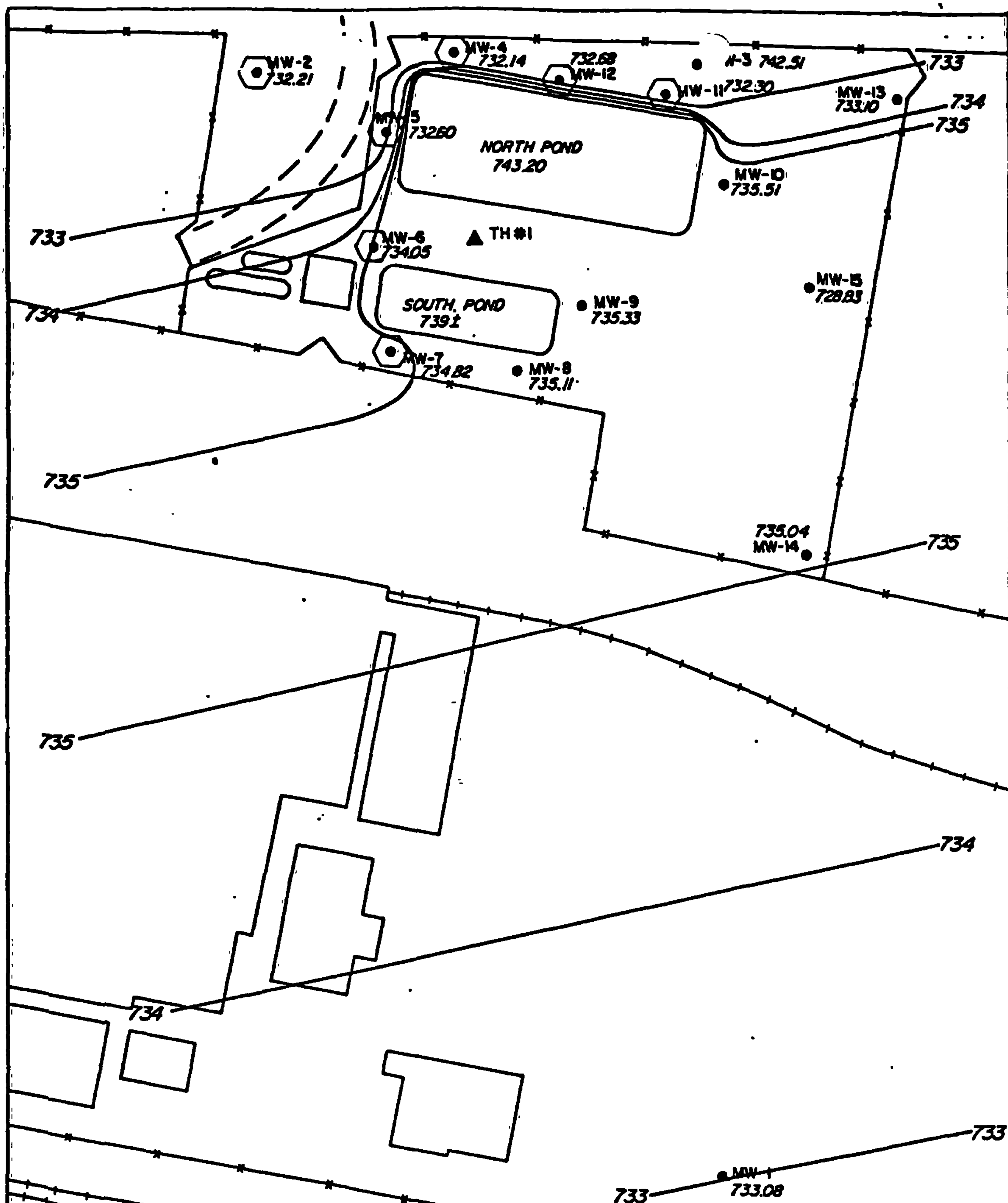
Hazardous waste constituents will be identified when the groundwater quality assessment plan is completed. Water quality standards will be proposed for these constituents if EPA standards do not already exist for use in a monitoring plan under Part 264 of 40 CFR.

BACKGROUND WATER QUALITY

Upon completion of the groundwater quality assessment plan, the background quality for the hazardous waste constituents identified in the plan will be estimated according to Part 264.97(g) of 40 CFR.

GROUNDWATER MONITORING PROGRAM

A groundwater monitoring program will be proposed consistent with Part 264.97 upon completion of the groundwater quality assessment plan. It is uncertain at this time weather a detection or compliance monitoring program will be appropriate.



Monitor Well and Boring Location Map
Showing Water Level Contours on 2/14/85
Globe Battery Division, Johnson Controls, Inc.
Caledonia Township, Shiawassee County, Michigan

0 100'

LEGEND

MW-29 ● MONITOR WELL
TH #1 ▲ TEST HOLE - NO WELL INSTALLED
739.04 — WATER LEVEL ELEVATION
—734— — WATER LEVEL CONTOUR
COMPLIANCE POINT

NORTH

3/6/85 KECK consulting services, inc.

The groundwater monitoring program will specify the sampling frequency, sampling methods, analytical procedures for the hazardous waste constituents, preservation and shipment methods, and chain of custody and control procedures.

Some general information on sampling methods, analytical procedures, preservation and shipment methods, and chain of custody and control procedures follows. This submittal was put together as recommended by Mr. Richard Traub of U.S. EPA in a telephone conversation on March 4, 1985 with Ms. Karen Ridgway. Information on the plume of contamination, hazardous waste constituents, and proposed groundwater quality standards and background concentrations for these hazardous waste constituents is needed to complete this section.

PROCEDURES:

Sample Collection:

Sampling procedures should insure that all samples are representative of the sampling point, uncontaminated during collection, preserved properly on-site and delivered to the laboratory within the required hold times. The major steps in the sampling process are as follows:

A. Field sampling will be performed by personnel who have been specifically trained in sample collection methods.

B. Static water levels in monitor well casings will be measured.

APPENDIX E-2

GROUNDWATER QUALITY DATA

ANALYTICAL RESULTS
GROUNDWATER SAMPLES - GLOBE BATTERY DIVISON
JULY, 1983
(REVISED SEPTEMBER 27, 1983)

PARAMETER	WELL NUMBER 1	2	3	3	4	BLANK
Endrin, mg/l	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	
Lindane, mg/l	<0.004	<0.004	<0.004	<0.004	<0.004	
Methoxychlor, mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	
Toxaphene, mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	
2,4-D	<0.1	<0.1	<0.1	<0.1	<0.1	
2,4,5-TP	<0.01	<0.01	<0.01	<0.01	<0.01	
Total Coliform/100 ml	<10	<10	50	30	<10	<10
Total Organic Halide, mg/l	0.0079	0.0098	<0.005	0.023	0.039	<0.005
	0.012	0.017	0.018	0.027	0.081	<0.005
	<0.005	0.077	0.005	<0.005	0.025	<0.005
	<0.005	0.0088	<0.005	<0.005	0.030	<0.005
Total Organic Carbon, mg/l	12	13	9.0	8.5	11	<2
	10	12	7.6	10	13	<2
	13	7.1	11	7.4	11	<2
	13	9.8	9.8	12	16	<2
α, pCi/l	<1	<1	<1	<1		<1
β, pCi/l	<1	<1	<1	<1		<1
pH	7.04	6.87	6.59	6.29	7.17	
	7.17	**	6.55	6.23	**	
	7.07	**	6.49	6.21	**	
	7.10	**	6.50	6.19	**	
Specific Conductance µmhos/cm	325 @ 12°C	1450 @ 24.5°C	500 @ 11.5°C	500 @ 13.5°C	9500 @ 25°C	
	335 @ 12.5°C	**	525 @ 13°C	530 @ 13.5°C	**	
	345 @ 13.8°C	**	540 @ 13.9°C	530 @ 14.0°C	**	
	340 @ 14.1°C	**	520 @ 14.5°C	530 @ 14.4°C	**	

** No duplicate valves obtained.

SWANSON ENVIRONMENTAL, INC.

TABLE NUMBER 3 (CONT'D)
ANALYTICAL RESULTS - GROUNDWATER SAMPLES
JOHNSON CONTROLS BATTERY DIVISION
OCTOBER 14, 1983

PARAMETER (mg/l)	WELL NUMBER 1	2	3	4
Total Coliform/100 ml	2	12	13	0
Total Organic Halide	0.038	0.052	0.062	3.3
	0.052	0.074	0.057	2.6
	0.057	0.063	0.16	1.7
	0.057	0.061	0.10	1.8
Total Organic Carbon	3.2	6.6	3.7	3.7
	3.7	5.8	2.2	3.4
	2.2	6.5	9.2	3.2
	4.3	6.8	<2.0	2.7
α, pCi/l	<1	<1	<1	<1
β, pCi/l	<1	<1	<1	<1
pH	8.02	7.79	7.70	7.93
	8.00	7.50	7.30	7.73
	8.06	7.42	7.40	7.84
	8.04	7.46	7.50	7.82
Specific Conductance umhos/cm	449	1095	783	848
	410	1198	843	873
(All at 25°C)	423	1121	843	873
	423	1147	783	873

TABLE 3
ANALYTICAL RESULTS - GROUNDWATER SAMPLES
JOHNSON CONTROLS BATTERY DIVISION
OWOSSO, MICHIGAN
OCTOBER 12 AND 23, 1984

PARAMETER (mg/l)	WELL NUMBER 1	2	3	4	3 (duplicate)	Blank
Total Organic Halide	0.170	0.023	0.013	0.011	0.019	0.170
	0.190	0.015	0.015	<0.010	0.017	0.200
	0.170	0.022	<0.010	0.030	0.016	0.220
	0.180	0.021	0.016	0.013	0.022	0.200
Total Organic Carbon	3.94	1.88	4.37	2.34	3.17	2.65
	4.28	1.57	2.23	2.77	2.17	2.79
	3.43	1.60	4.11	2.68	2.57	3.20
	3.64	1.67	3.96	2.52	2.79	2.72
pH	5.5	5.7	6.4	6.2	6.7	-
	5.8	6.3	6.5	6.3	6.7	-
	5.4	6.5	6.5	6.4	6.7	-
	5.5	6.4	6.6	6.6	6.7	-
Specific Conductance	320	790	650	460	625	-
umhos/cm	329	780	625	460	625	-
	319	780	625	460	610	-
(All at 15°C)	311	750	625	460	610	-

TABLE 3 (CONT'D)
ANALYTICAL REPORTS - GROUNDWATER SAMPLES
JOHNSON CONTROLS BATTERY DIVISION
APRIL 23 AND 26, 1984

	WELL NUMBER					
PARAMETER (mg/l)	1	2	3	4	3 (duplicate)	Blank
Endrin	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Lindane	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Methoxychlor	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Toxaphene	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
2,4-D	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2,4,5-TP (Silvex)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Coliform/100 ml	<1	1	35	<1	56	<1
Total Organic Halide	0.006	0.038	0.041	0.020	B	0.084
	0.017	0.035	0.081	0.025	B	0.084
	0.013	0.033	0.018	0.032	B	0.021
	0.014	0.035	0.019	0.044	B	0.043
Total Organic Carbon	2.7	3.6	4.7	3.6	3.9	0.2
	1.8	3.0	3.7	2.1	3.7	0.3
	2.6	5.1	3.9	2.4	3.4	0.2
	2.7	2.4	4.4	3.4	4.1	0.2
α, pCi/l	3.0	2.0	3.0	<1	<1	4
β, pCi/l	5.6	<1	6.0	2.8	<1	<1
pH	7.94	8.14	7.94	8.34	8.08	6.33
	7.95	8.15	7.95	8.34	8.11	6.32
	7.96	8.16	7.96	8.35	8.13	6.31
	8.00	8.17	7.96	8.34	8.14	6.32
Specific Conductance	385	1000	729	643	703	0
umhos/cm	397	958	729	643	716	0
	410	958	729	643	730	0
(All at 25°C)	423	958	729	643	730	0

B = Broken during Shipment.

TABLE 3 (CONT'D)
ANALYTICAL RESULTS - GROUNDWATER SAMPLES
JOHNSON CONTROLS BATTERY DIVISION
JANUARY 17 AND 20, 1984

PARAMETER (mg/l)	WELL NUMBER 1	2	3	4	3 (duplicate)	Blank
Endrin	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Lindane	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Methoxychlor	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Toxaphene	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
2,4-D	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2,4,5-TP	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Coliform/100 ml	100	2	0	0	3	0
Total Organic Halide	0.078	0.015	0.025	0.013	0.084	0.016
	0.074	0.16	0.017	0.026	0.012	0.098
	0.069	0.022	0.011	0.020	0.009	0.013
	0.067	0.019	0.020	0.014	0.006	0.100
Total Organic Carbon	6	8	8	3	6	<1
	9	7	5	2	6	<1
	7	13	11	7	3	<1
	16	15	11	6	5	<1
α, pCi/l	<1	<1	<1	<1	<1	<1
β, pCi/l	<1	<1	<1	<1	<1	<1
pH	7.55	7.90	7.50	8.15	7.30	8.25
	7.70	7.80	7.35	8.05	7.40	8.40
	7.65	7.85	7.45	8.00	7.45	8.20
	7.75	7.80	7.40	7.95	7.35	8.00
Specific Conductance	507	1232	886	708	753	0
umhos/cm	500	1243	800	722	716	0
	493	1257	929	726	793	0
(All at 25°C)	507	1229	886	726	793	0

TABLE 3 (CONT'D)
ANALYTICAL RESULTS - GROUNDWATER SAMPLES
JOHNSON CONTROLS BATTERY DIVISION
APRIL 23 AND 26, 1984

PARAMETER (mg/l)	WELL NUMBER 1	2	3	4	3 (duplicate)	Blank
METALS TOTAL:						
Arsenic	<0.001	B	<0.001	<0.001	<0.001	<0.001
Barium	0.08	B	0.02	0.11	0.04	<0.01
Cadmium	0.010	B	0.009	0.009	0.011	0.003
Calcium	63.4	B	102.8	144.0	103.0	1.2
Chromium	<0.01	B	<0.01	0.02	<0.01	<0.01
Copper	0.01	B	0.02	<0.01	0.01	0.01
+ Iron Std 0.3 Bkgrnd well?	0.55	B	1.40	0.12	0.14	0.01
Lead	0.0377	B	0.0147	0.0093	0.0129	<0.0001
Magnesium	17.38	B	36.18	45.88	35.48	0.08
Manganese exceeded 0.06 on Jan 17+20	0.03	B	0.16	0.11	0.13	<0.01
Mercury	<0.0001	<0.0001	0.0007	<0.0001	<0.0001	0.0005
Selenium	0.0007	B	0.0005	0.0007	0.0006	0.0008
Silver	<0.01	B	<0.01	<0.01	<0.01	<0.01
Sodium	10.0	B	13.8	14.2	14.6	0.7
Zinc	0.041	B	0.012	0.030	0.012	0.079

B = Broken during shipment.

TABLE 3
ANALYTICAL RESULTS - GROUNDWATER SAMPLES
JOHNSON CONTROLS BATTERY DIVISION
JULY 6 AND 10, 1984

	WELL NUMBER					
PARAMETER (mg/l)	1	2	3	4	3 (duplicate)	Blank
Chloride	<1.0	102	25.5	<2.0	25.6	-
Fluoride	0.64	0.33	0.20	0.62	0.20	-
Nitrogen, Nitrate as N	0.006	0.067	0.013	-	0.014	-
Phenols	<0.005	<0.005	<0.005	-	<0.005	-
Sulfate	23	125	43	109	47	
METALS (Filtered):						
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	0.45	0.75	0.65	0.39	0.64	<0.01
Cadmium .01	0.006	0.008	0.012	0.009	.031	0.003
Chromium	0.01	0.02	0.01	0.01	0.01	0.01
Iron	0.13	0.04	0.03	0.03	0.03	0.03
Lead	0.0035	0.0009	0.0038	0.0018	0.0040	0.0007
Manganese	0.03	0.03	0.12	0.02	0.13	<0.01
Mercury	0.0002	0.0002	0.0005	0.0005	0.0003	0.0006
Selenium	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	7.8	59.6	13.0	32.0	12.4	0.29
Total Organic Carbon	5.0	29.0	7.0	-	7.0	-
pH	7.72	8.05	7.43	-	7.48	-
Specific Conductance umhos/cm (All at 25°C)	580	1,100	840	-	840	-
Total Organic Halide	<0.010	<0.010	<0.010	<0.010	0.011	<0.010
	0.046	<0.010	<0.010	<0.010	<0.010	<0.010
	<0.010	<0.010	0.013	<0.010	0.030	<0.010
	0.013	<0.010	<0.010	0.020	<0.010	<0.010

TABLE 3 (CONT'D)
ANALYTICAL REPORTS - GROUNDWATER SAMPLES
JOHNSON CONTROLS BATTERY DIVISION
JANUARY 17 AND 20, 1984

	WELL NUMBER					
PARAMETER (mg/l)	1	2	3	4	3 (duplicate)	Blank
METALS TOTAL:						
Arsenic	0.0005	<0.0001	<0.0001	0.0039	<0.0001	<0.0001
Barium	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	0.004	0.008	0.010	0.023	0.008	0.001
Calcium	59	120	87	170	91	0.09
Chromium	0.01	0.01	<0.01	0.03	0.01	<0.01
Copper	0.01	0.01	0.02	0.03	0.01	0.01
Iron	0.55	0.14	0.25	67.9	1.83	0.05
Lead	0.0052	0.0029	0.0045	0.0153	0.0101	<0.0001
Magnesium	21.3	56.1	34.1	54.8	36.4	0.022
Manganese	0.07	0.02	0.13	15.8	0.16	0.01
Mercury	0.0002	<0.0001	0.0001	<0.0001	<0.0001	<0.0001
Selenium	<0.0005	<0.0005	<0.0005	0.0004	<0.0005	<0.0005
Silver	<0.01	0.01	<0.01	0.01	0.01	<0.01
Sodium	9.46	11.0	10.3	10.6	9.25	0.60
Zinc	0.07	0.07	0.05	0.18	0.04	0.03

TABLE 3
ANALYTICAL RESULTS - GROUNDWATER SAMPLES
JOHNSON CONTROLS BATTERY DIVISION
JANUARY 17 AND 20, 1984

PARAMETER (mg/l)	WELL NUMBER 1	2	3	4	3 (duplicate)	Blank
Alkalinity, Bicarb	251	295	289	246	287	15
Alkalinity, Total, as $CaCO_3$	251	295	289	246	287	15
Chemical Oxygen Demand	20.2	8.8	5.6	19.7	7.3	<1.0
Chloride	4.8	154	37.9	4.2	35.4	<1.0
Cyanide	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoride	1.42	0.45	0.33	1.40	0.30	0.14
Nitrogen, Ammonia	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrogen, Nitrate	0.017	0.415	0.008	0.007	0.006	<0.005
Phenols	0.013	0.009	0.007	0.006	0.008	<0.005
Sufate	30	148	46	96	42	<2
METALS (FILTERED):						
Arsenic	0.0008	<0.0001	<0.0001	0.0001	0.0001	<0.0001
Barium,	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	0.006	0.007	0.007	0.003	0.006	0.001
Calcium	52	110	85	55	84	0.12
Chromium	0.01	0.02	0.02	0.01	0.01	0.01
Copper	0.02	0.01	0.02	0.01	0.01	0.01
Iron	2.23	0.05	0.07	0.17	0.10	0.06
lead	0.0048	0.0017	0.0012	<0.0001	0.0031	<0.0001
Magnesium	19.4	57.3	34.9	29.0	34.3	0.010
Manganese	0.12	0.02	0.12	0.04	0.12	<0.01
Mercury	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001
Selenium	<0.0005	0.0002	<0.0005	<0.0005	<0.0005	<0.0005
Silver	0.01	0.01	0.01	0.01	0.01	<0.01
Sodium	9.45	10.7	9.60	9.41	9.55	0.48
Zinc	0.08	0.05	0.09	0.06	0.06	0.06

TABLE 3
ANALYTICAL RESULTS - GROUNDWATER SAMPLES
JOHNSON CONTROLS BATTERY DIVISION
APRIL 23 AND 26, 1984

	WELL NUMBER					
PARAMETER (mg/l)	1	2	3	4	3 (duplicate)	Blank
Alkalinity, Bicarb	229	267	307	226	316	<1.0
Alkalinity, Total, as $CaCO_3$	229	267	307	226	316	<1.0
Chemical Oxygen Demand	11.4	15.1	15.1	9.5	15.1	13.2
Chloride	<1.0	103	29.6	<1.0	28.2	<1.0
Cyanide	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoride	0.73	0.32	0.19	0.64	0.19	<0.10
Nitrogen, Ammonia as N	0.10	<0.10	<0.10	0.13	<0.10	<0.10
Nitrogen, Nitrate as N	<0.010	0.345	<0.010	<0.010	<0.010	<0.010
Phenols	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Sulfate	14	93	47	160	46	9
METALS (Filtered):						
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	0.05	0.17	0.07	0.04	0.04	0.04
Cadmium	0.006	0.011	0.007	0.003	0.011	0.002
Calcium	62.0	105.0	100.8	62.8	100.8	1.2
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	0.01	0.02	0.02	0.01	0.02	0.01
Iron	0.02	0.03	0.02	0.01	0.07	0.02
Lead	0.0087	0.0017	0.0021	<0.0001	0.0080	<0.0001
Magnesium	17.72	39.80	35.54	30.32	35.00	0.08
Manganese	0.02	0.01	0.11	0.04	0.12	<0.01
Mercury	NA	NA	NA	NA	NA	NA
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	9.7	47.3	14.0	31.4	14.1	0.8
Zinc	0.047	0.040	0.048	0.026	0.088	0.016

NA = Not Applicable

ANALYTICAL RESULTS
GROUNDWATER SAMPLES - GLOBE BATTERY DIVISION
JULY, 1983
(REVISED SEPTEMBER 27, 1983)

PARAMETER	WELL NUMBER 1	2	3	3	4	BLANK
Alkalinity, Bicarb, mg/l	242	315	342	369	230	<1.0
Alkalinity, Total, mg/l as $CaCO_3$	242	315	342	369	230	<1.0
Chloride, mg/l	2.3	24.1	19.8	20.3	10.7	1.6
Chemical Oxygen Demand, mg/l	3.3	26	8.0	13	17	<2
Cyanide, mg/l	<0.10	<0.10	<0.10	<0.10	*	<0.10
Fluoride, mg/l	0.91	0.74	0.26	0.27	1.10	<0.10
Nitrogen, Ammonia, mg/l	0.15	6.31	<0.1	<0.1	0.10	<0.1
Nitrogen, Nitrate, mg/l	0.018	0.019	0.011	0.047	0.014	0.127
Phenols, mg/l	<0.005	<0.005	<0.005	0.010	<0.005	<0.005
Sulfate, mg/l	65	800	100	90	330	7
Arsenic, mg/l	<0.001	0.051	<0.001	<0.001	0.017	<0.001
Barium, mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Calcium, mg/l	63.9	187	98.0	100	123	<0.1
Cadmium, mg/l	0.002	0.009	0.002	0.002	0.010	<0.001
Chromium, Total, mg/l	0.01	0.04	0.01	<0.01	0.02	0.01
Copper, mg/l	0.01	0.03	0.01	0.01	0.03	<0.01
Iron, mg/l	11.59	50.7	3.85	3.25	21.4	0.20
Lead, mg/l	0.051	0.013	0.007	0.008	0.058	<0.001
Magnesium, mg/l	20.4	86.1	37.6	37.1	52.3	<0.1
Manganese, mg/l	0.34	1.76	0.20	0.19	0.73	<0.01
Mercury, mg/l	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Selenium, mg/l	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Silver, mg/l	<0.01	0.02	<0.01	<0.01	<0.01	<0.01
Sodium, mg/l	7.1	46.7	13.1	13.2	74.6	0.2
Zinc, mg/l	0.067	0.187	0.033	0.072	0.300	0.004

* No sample sent for cyanide analysis.

TABLE NUMBER 3
ANALYTICAL RESULTS - GR 'NDWATER SAMPLES
JOHNSON CONTROLS BATTER. DIVISION
OCTOBER 14, 1983

PARAMETER (mg/l)	WELL NUMBER 1	2	3	4
Alkalinity, Bicarb	245	283	190	234
Alkalinity, Total, as $CaCO_3$	245	283	190	234
Chloride	1.3	13.0	45.4	5.0
Chemical Oxygen Demand	9.4	15.1	10.4*	17.9
Cyanide	<0.01	<0.01	<0.01	<0.01
Fluoride	0.76	0.52	0.25	0.74
Nitrogen, Ammonia	0.84	0.55	0.70	0.88
Nitrogen, Nitrate	<0.005	0.011	0.022	<0.005
Phenols	0.007	0.008	<0.005	<0.005
Sulfate	18	400	38	300
Arsenic	0.004	0.073	0.008	0.010
Barium	<0.1	<0.1	<0.1	<0.1
Calcium	33.8	86.3	64.4	28.8
Cadmium	0.007	0.008	0.010	0.007
Chromium	<0.01	<0.01	0.01	<0.01
Copper	0.01	0.02	0.02	0.02
Iron	0.12	2.19	0.16	0.80
Lead	0.0015	0.0119	0.0054	0.0052
Magnesium	13.2	64.5	37.1	28.1
Manganese	0.05	0.11	0.10	0.06
Mercury	<0.0002	<0.0002	<0.0002	<0.0002
Selenium	<0.001	<0.001	<0.001	<0.001
Silver	<0.01	<0.01	<0.01	<0.01
Sodium	7.7	37.2	19.2	53.5
Zinc	0.010	0.008	0.028	0.027
Endrin	<0.0002	<0.0002	<0.0002	<0.0002
Lindane	<0.004	<0.004	<0.004	<0.004
Methoxychlor	<0.1	<0.1	<0.1	<0.1
Toxaphene	<0.005	<0.005	<0.005	<0.005
2,4-D	<0.1	<0.1	<0.1	<0.1
2,4,5-TP	<0.01	<0.01	<0.01	<0.01

APPENDIX E-3

GROUNDWATER QUALITY STATISTICS

Statistical Analysis of Groundwater Monitoring Results
Battery Division
October 1984 sampling period

pH Analysis

Well 1

$\bar{x}_b = 7.69$ $\bar{x}_m = 5.55$

$s_b^2 = 0.1476$ $s_m^2 = 0.03$ $w_b = .1476/16 = .0092$

$n_b = 16$ $n_m = 4$ $w_m = 0.03/4 = .0075$

$t_b = 2.947$ $t_m = 5.841$

$$t^* = \frac{5.55 - 7.69}{\sqrt{\frac{.03}{4} + \frac{.1476}{16}}} = -16.5474$$

$$t_c = \frac{(.0092)(2.947) + (.0075)(5.841)}{(.0092) + (.0075)} = 4.2467$$

$|t^*| > |t_c|$ and t^* is negative, therefore Well 1 shows a significant decrease in pH.

Well 2

$\bar{x}_b = 7.69$ $\bar{x}_m = 6.22$

$s_b = 0.1476$ $s_m^2 = .1292$ $w_b = .1476/16 = .0092$

$n_b = 16$ $n_m = 4$ $w_m = .1292/4 = .0323$

$t_b = 2.947$ $t_m = 5.841$

$$t^* = \frac{6.22 - 7.69}{\sqrt{\frac{.1292}{4} + \frac{.1476}{16}}} = -7.2138$$

$$t_c = \frac{(.0092)(2.947) + (.1292)(5.841)}{.0092 + .0323} = 18.8378$$

$|t^*| < |t_c|$, therefore there is no significant change.

pH con'd

Well 3

$\overline{x}_b = 7.69$ $\overline{x}_m = 6.5$

$s_b^2 = 0.1476$ $s_m^2 = .0067$ $w_b = .1476/16 = .0092$

$n_b = 16$ $n_m = 4$ $w_m = .0067/4 = .0017$

$t_b = 2.947$ $t_m = 5.841$

$$t^* = \frac{6.5 - 7.69}{\sqrt{\frac{.0067}{4} + \frac{.1476}{16}}} = -11.3981$$

$$t_c = \frac{(.0092)(2.947) + (.0017)(5.841)}{.0092 + .0017} = 3.3983$$

$|t^*| > |t_c|$ and t^* is negative, therefore Well 3 shows a significant decrease in pH.

Well 4

$\overline{x}_b = 7.69$ $\overline{x}_m = 6.37$

$s_b^2 = 0.1476$ $s_m^2 = .0292$ $w_b = .1476/16 = .0092$

$n_b = 16$ $n_m = 4$ $w_m = .0292/4 = .0073$

$t_b = 2.947$ $t_m = 5.841$

$$t^* = \frac{6.37 - 7.69}{\sqrt{\frac{.0292}{4} + \frac{.1476}{16}}} = -10.2684$$

$$t_c = \frac{(.0092)(2.947) + (.0073)(5.841)}{.0092 + .0073} = 4.227$$

$|t^*| > |t_c|$ and t^* is negative, therefore Well 4 shows a significant decrease in pH.

Sepcific Conductance Analysis

Well 1

$\bar{x}_b = 413.92$ $\bar{x}_m = 319.75$

$s_b^2 = 5141.90$ $s_m^2 = 54.25$

$n_b = 12$ $n_m = 4$

$t_b = 2.718$ $t_m = 4.541$

$$t^* = \frac{319.75 - 413.92}{\sqrt{\frac{54.25}{4} + \frac{5141.9}{12}}} = -4.4789$$

t* is negative, therefore no significant increase

Well 2

$\bar{x}_b = 413.92$ $\bar{x}_m = 775$ $w_b = 5141.9/12$

$s_b^2 = 5141.90$ $s_m^2 = 300$ $w_m = 300/4$

$n_b = 12$ $n_m = 4$

$t_b = 2.718$ $t_m = 4.541$

$$t^* = \frac{775 - 413.92}{\sqrt{\frac{300}{4} + \frac{5141.90}{12}}} = 16.0919$$

$$t_c = \frac{(428.49)(2.718) + (75)(4.541)}{428.49 + 75} = 2.9895$$

$t^* > t_c$ therefore there is a significant increase

Well 3

$\bar{x}_b = 413.92$ $\bar{x}_m = 631$

$s_b^2 = 5141.90$ $s_m^2 = 156.25$ $w_b = 5141.9/12$

$n_b = 12$ $n_m = 4$ $w_m = 156.25/4$

$t_b = 2.718$ $t_m = 4.541$

$$t^* = \frac{631 - 413.92}{\sqrt{\frac{156.25}{4} + \frac{5141.9}{12}}} = 10.0393$$

$$t_c = \frac{(428.49)(2.718) + (39.06)(4.541)}{428.49 + 39.06} = 2.8703$$

$t^* > t_c$, therefore Well 3 shows a significant increase in specific conductance

Well 4

$\bar{x}_b = 413.92$ $\bar{x}_m = 460$

$s_b^2 = 5141.90$ $s_m^2 = 0$ $w_b = 5141.9/12$

$n_b = 12$ $n_m = 4$ $w_m = 0/4$

$t_b = 2.718$ $t_m = 4.541$

$$t^* = \frac{460 - 413.92}{\sqrt{\frac{0}{4} + \frac{5141.9}{12}}} = 2.2261$$

$$t_c = \frac{(428.49)(2.718) + (0)(4.541)}{428.49 + 0} = 2.718$$

$t^* < t_c$, therefore there is no significant increase

TOC Analysis

<u>Well 1</u>

$\bar{x}_b = \underline{6.82}$ $\bar{x}_m = \underline{3.82}$

$s_b^2 = 22.04$ $s_m^2 = .1368$

$n_b = 16$ $n_m = 4$

$t_b = 2.602$ $t_m = 4.541$

no significant increase

<u>Well 2</u>

$\bar{x}_b = \underline{6.82}$ $\bar{x}_m = \underline{1.68}$

no significant increase

<u>Well 3</u>

$\bar{x}_b = \underline{6.82}$ $\bar{x}_m = \underline{3.66}$

no significant increase

<u>Well 4</u>

$\bar{x}_b = \underline{6.82}$ $\bar{x}_m = \underline{2.67}$

no significant increase

TOH Analysis

Well 1

$\bar{x}_b = 0.0357$ $\bar{x}_m = .1775$

$s_b^2 = 0.0008$ $s_m^2 = .0001$ $w_b = .0008/16$

$n_b = 16$ $n_m = 4$ $W_m = .0001/4$

$t_b = 2.602$ $t_m = 4.541$

$$t^* = \frac{.1775 - 0.0357}{\sqrt{\frac{.0001}{4} + \frac{.0008}{16}}} = 16.3737$$

$$t_c = \frac{(.00005)(2.602) + (.000025)(4.541)}{.00005 + .000025} = 3.2483$$

$t^* > t_c$, therefore Well 1 shows a significant increase in TOH

Well 2

$\bar{x}_b = 0.0357$ $\bar{x}_m = .0203$

$s_b^2 = 0.0008$ $s_m^2 = .0000129$

$n_b = 16$ $n_m = 4$

$t_b = 2.602$ $t_m = 4.541$

$\bar{x}_m < \bar{x}_b$, therefore no significant increase.

Well 3

$\bar{x}_b = 0.0357$ $\bar{x}_m = .0135$

$\bar{x}_m < \bar{x}_b$, therefore no significant increase.

Well 4

$\bar{x}_b = 0.0357$ $\bar{x}_m = .016$

$\bar{x}_m < \bar{x}_b$, therefore no significant increase.

JOHNSON CONTROLS, INC.
BATTERY DIVISION, OWOSSO, MICHIGAN

Sampling Date: 12/09/84

MW-2

S.C.	Temperature	
820 umhos/cm	14°C	Start at 11°C to equil
835 umhos/cm	14°C	

MW-3

pH	S.C.	Temperature
6.85	398 umhos/cm	8°C
6.95	401 umhos/cm	8°C

MW-4

pH	Temperature
7.45	54°F
7.45	

STATISTICAL ANALYSIS OF GROUNDWATER MONITORING RESULTS
BATTERY DIVISION
DECEMBER, 1984 SAMPLING PERIOD

WELL 2 - SPECIFIC CONDUCTANCE

$\bar{X}_b = 413.92$	$\bar{X}_m = 820$	$\bar{X}_m = 835$	$\bar{X}_m = 827.5$
$S_b^2 = 5141.9$	$S_m^2 = 0$		$S_m^2 = 112.5$
$n_b = 12$	$n_m = 1$		$n_m = 2$
$t_b = 2.718$	$t_m = 0$		$t_m = 31.821$

$$t^* = \frac{827.5 - 413.92}{\sqrt{\frac{5141.9}{12} + \frac{112.5}{2}}} = 18.78$$

$$t_c = \frac{(428.49)\ (2.718) + (31.821)\ (56.25)}{428.49 + 56.25} = \frac{2,954.5671}{484.74} = 6.09$$

$t^* > t_c$ therefore there is a significant increase.

WELL 3 SPECIFIC CONDUCTANCE

$\bar{x}_b = 413.92$ $\qquad$ $\bar{x}_m = 399.5$

$s_b^2 = 5141.9$ $\qquad$ $s_m^2 = 4.5$

$n_b = 12$ $\qquad$ $n_m = 2$

$t_b = 2.718$ $\qquad$ $t_m = 31.821$

$$t^* = \frac{399.5 - 413.92}{\sqrt{\frac{5141.9}{12} + \frac{4.5}{2}}} = -.6948$$

$$t_c = \frac{(428.49)\ (2.718)+(2.25)(31.821)}{428.49 + 2.25} = 2.87$$

$t^* < t_c$, therefore there is no significant change

WELL 3 pH

$\bar{x}_b = 7.69$ $\qquad$ $\bar{x}_m = 6.9$

$s_b^2 = 0.1476$ $\qquad$ $s_m^2 = .005$

$n_b = 16$ $\qquad$ $n_m = 2$

$t_b = 2.947$ $\qquad$ $t_m = 63.657$

$$t^* = \frac{6.9 - 7.69}{\sqrt{\frac{.1476}{16} + \frac{.005}{2}}} = {}^{-}7.2958$$

$$t_c = \frac{(.0092)(2.947)+(63.657)(.0025)}{.0092 + .0025} = 15.919$$

$/t^*/ < /tc/$, therefore there is no significant change

WELL 4 pH

$\bar{x}_b = 7.69$

$s_b^2 = 0.1476$

$n_b = 16$

$t_b = 2.947$

$\bar{x}_m = 7.45$

$s_m^2 = 0$

$n_m = 2$

$t_m = 63.657$

$$t^* = \frac{7.45 - 7.69}{\sqrt{\frac{.1476}{16}}} = {}^{-}2.4988$$

$$t_c = \frac{(.0092)(2.947)}{.0092} + 0 = 2.947$$

$/t^*/ < /t_c/$, therefore there is no significant change

RESPONDENT CONTACT RECORD (RCR)

FACILITY ID NUMBER	COMPANY NAME		
	Johnson Controls, Inc		
COMPANY ADDRESS	**CITY**	**STATE ABBREV.**	**ZIP CODE**
CONTACT PERSON'S NAME/TITLE		**TELEPHONE NUMBER (INCLUDE AREA CODE)**	

CONTACT RECORD

DATE	CONTRACTOR'S INITIALS	ITEMS DISCUSSED/RESOLUTION
7-28	Called	Person to contact needed.